PROBLEMS OF FIRE INSURANCE RATEMAKING

By Robert Riegel, Ph.D.,
Instructor in Insurance, Wharton School of Finance and Commerce, University of Pennsylvania.

Early Rating Methods

The first theory of rating risks to be covered by fire insurance was a classification of buildings (which were for some time the only property insured) into groups, each risk included in the group taking the group rate. In 1681 there were two such classes in England, brick or stone buildings and wooden buildings, and premiums were proportionate to rental values. For each one pound annual rental 2 s. 6 d. was charged for insuring a brick or stone building and double this amount for a wooden building. The classification system thus begun continued for many years and a relic still remains in the minimum or class rates which are now promulgated for groups of properties closely resembling each other, the results of specific rating for these not being commensurate with the expense involved. The inability to insure personal property and the calculation of premiums on a rental basis have long since disappeared, and rates, furthermore, are no longer applied to rental values. In 1706 a London office classified risks in three categories, common, hazardous and doubly hazardous and, turning attention now to the United States, a Massachusetts company in 1798 devised a sixfold classification of buildings. The classification was in accord with construction, roof and walls and a contents classification comprised hazardous and non-hazardous groups, the rates for contents depending in part upon the character of the containing building. A combination of companies in New York in 1826 agreed upon a building classification of eight groups and a division of contents into four groups, ranging from non-hazardous to specially hazardous.

These brief comments upon the history of rating methods are merely intended to illustrate the inevitable tendency of early underwriters to *classify* risks for the purpose of arriving at rates. Prior to 1870, for example, all risks in the state of Pennsylvania were rated on the classification basis, such classification being based on whether the building was of brick or frame construction and the presence

or absence of fire protection. The less the knowledge of fire hazards the greater the readiness to classify and group, or to put the matter in another way, the more thorough the analysis of hazard and the appreciation of differences the greater became the number of groups and the difficulty of assigning a risk to a particular group. The early application of the classification method is of particular interest because of the recently developed demand for a reversion to that principle of ratemaking.

THE DIMINISHING USEFULNESS OF CLASSIFICATION

Between 1835 and 1866 many companies introduced the practice of recording their experience with each of a large number of classes of risks with the object of deriving some information relative to the necessary rates upon such classes and the custom continued for many years after its usefulness for this purpose had disappeared. With an increased appreciation of the multitude of differences in construction, use and situation of buildings and the nature and qualities of substances the classifications necessarily multiplied, but the latter could not keep up with the changes taking place in the risks themselves. Modern conditions made the classification method of rating increasingly difficult. With increased knowledge and accessibility of material building construction became more varied and to place a building in a definite class became a more difficult problem. The introduction of machinery as a factor in production created a greater variety of occupancies and processes and an almost universal use of power generated in various ways. Heating and lighting methods were also radically modified. It is significant that what a prominent student of rating methods calls "the first real schedule" was devised in 1868 and that a great development in schedules had taken place by 1890; for the nineteenth century was prolific in inventions which radically altered industrial and trade conditions. Whole new industries were created by the telegraph and telephone, used commercially after 1844 and 1876, respectively; the practical application of coal gas production in 1798; the use of coal tar products after 1861 and other inventions too numerous to mention. Electricity and steam were more fully developed as sources of power. During this century the dynamo and electric light came into general use following 1870, the Howe printing press was brought out about 1845, the Bessemer process was invented in

1855, and there had appeared even earlier the power loom, the cotton gin, gas lighting, and knitting machines. From 1836 to 1867 the number of patents issued annually in the United States increased from 109 to 13,026. The alterations thus brought about created a multiplicity of hazards which made the old classification ideas almost useless for the purpose of rating.

A few instances may be cited of the difficulties encountered in attempting to classify risks. A group, to be of any value for rate-making purposes, must consist of a sufficiently large number of risks of essentially the same hazard; but so many and unlike were the elements of fire hazard that it became impossible to obtain sufficient like risks to form a valid class. Then there was the difficulty of classifying a building containing diverse occupancies and congregated hazards. Thirdly, with the increasing impracticability of classification developed an ever-growing "miscellaneous" group of heterogeneous and unrelated risks. Furthermore, since the classifications were comparisons of premium income and losses on different classes of risks, and since both premium rates and losses were almost if not entirely independent variables, differences in results were attributable to either and conclusions reached were often erroneous.

Sufficient has been said to show that classification of this kind had outlived its usefulness as a method of measuring fire hazard. It became instead a weapon of competition, almost *prima facie* evidence of lack of coöperation. Each company jealously guarded the results shown by its records and considered them as a part of its stock in trade, indicating the classes of risks which had proved profitable in the past and serving as a guide for future policy. The following is an example of ten years' classified experience (1900–1909) of a prominent fire insurance company,[1] showing that with such a variety of risks included in one class and with losses attributable to many different causes, such a record is not available as a basis for rates:

RETAIL MERCANTILE STOCKS

Income		*Outgo*	
No. of policies	188,282	Expenses	(unknown)
Insurance written	$257,594,702	Number of losses	6,504
Premiums received	2,965,776	Amt. of losses	$2,203,180

[1] Reproduced from E. G. Richards, "Classification—Discrimination," an address before the Insurance Society of New York, 1913.

Average and Ratios

Average premium rate for 10 years	1.15%
Average premium rate for 1911	1.14%
Ratio of loss to amount insured	.85
Ratio of loss to premiums	74.2

Income includes premiums widely ranging from low to very high, upon more than a hundred varieties of stores, in buildings of every quality, surrounded by every class of tenant and exposure.

Losses include those caused by accident, incendiarism, tenants, and exposure. Lightning not infrequent. Conflagration hazard the most serious cause.

DEVELOPMENT OF SCHEDULES

For some time rates were adapted to conditions through the medium of inspectors. But since the judgments of individual inspectors varied and no evidence of the justice of a rate thus made ever existed, not to mention that the same inspector would often rate the same hazard differently at two different times, individual judgment was superseded by a system based on combined judgment, now designated the "schedule" system. This has been called "guesswork" but it is as far from that as from science. It would be more accurate to call the schedule process one of "estimation." The advantages of the schedule may be briefly summarized as follows:

1. It attempted an analysis of fire hazard into component parts. Thus even the early schedule of 1868 previously mentioned subdivided construction into walls, roof, floors and floor openings and distinguished heating methods, lighting methods, processes, fire extinguishing devices, etc., as elements of hazard.

2. A schedule furnishes a list of the conditions which the inspector can look for, diminishing the probability of overlooking defects or good features. Thus he is enabled to view the risk with a guide-book at hand, so to speak, indicating the places of interest.

3. A combination of judgments was obtained in determining the charges to be made for the particular features of hazard distinguished by the analysis. It might at least be expected that a smaller percentage of error would be present under such conditions than would appear in the single estimate of any individual inspector. This factor became of increasing importance with the progress of schedule making.

Since no compilation of the various early schedules has ever been made it is impossible to trace in detail the development of the

rating schedule. In New England schedules covering boot and shoe factories are said to have been first in use, followed by those covering woolen mills, fur hat factories, leather tanneries, etc. One writer attaches particular importance to the 1868 "woolen mills schedule" of Providence. From this date on the schedules in use multiplied rapidly. It is recorded that in St. Louis they were first adopted and printed in 1875. By 1890 a number of small mercantile schedules began to appear.

To avoid confusion it should also be stated that while the schedule has been of increasing importance as a factor in rating it has not entirely displaced the classification theory. For there are certain "minimum" rates still prescribed quite generally for non-hazardous classes of risks of a same general nature, such as dwellings, churches, etc. It is not very difficult to secure a number of such risks sufficient to produce a good average and the differences in hazard as between properties of such classes are so small as to render the expense of separate consideration impracticable. In one locality at least steps have been taken to rate even risks of this nature by schedule.

THE MODERN SCHEDULE

The modern era of schedule rating may be justifiably said to begin with the publication in 1893 of the Universal Mercantile Schedule, an attempt to devise a system of rating universally applicable and to render special schedules unnecessary. While seldom applied as published this schedule has served as a basis for the construction of other schedules throughout the East and has thereby exerted a profound influence on the methods of rating. While a description of the construction of the schedule and its application would occupy considerable space, its underlying principles and general theory can be sufficiently described for present purposes in a few paragraphs.

This schedule started from a basis rate for a "standard" building in a "standard" city. It was necessary for the underwriters engaged in the preparation of the schedule to accurately define therefore a "standard" city and also a "standard" building. Having done so their combined judgment and such experience records as were available and suitable dictated a rate on such a building under such conditions of 25 cents per $100 of insurance.

This figure was the result, then, of a combination of judgments or, stated in another way, a concensus of opinions. It was then necessary to decide what the rate should be on a standard building in a given city and for this purpose the given city is compared with the standard and additions to the basis rate made for deficiencies and deductions from the same for superiorities. The result is called the "key rate." In order to find the rate for a given building the construction, occupancy and exposure of the building in question must be considered. Additions made to the "key rate" for inferiorities of the building construction as compared with the standard together with allowances[2] for superiorities bring the calculations nearer to the final result, which is reached when additions are made for the use of the building and the nature of its surroundings and deductions for protective devices and any other circumstances reducing the hazard.[3] Additions to the rate for hazardous features are in general by flat amounts while allowances are usually made on the basis of percentages of the rate up to the point where the deduction is made.

Three features of this schedule present themselves as worthy of special note in connection with the present discussion. In the first place the Universal Schedule is a schedule preëminently dependent upon judgment. The basis rate is an approximation designed to bring as an ultimate result a fair profit to the companies and to cover unanalyzed features of hazard. The charges for defects and allowances for superiorities are the result of limited data and extensive estimates.[4] The authors of the schedule have stated that they considered the substitution of combined for individual judgment as one of its important contributions, as indeed it was. Secondly, the schedule was adaptable only with difficulty to changing conditions. Loss costs are always changing while many of the schedule charges were fixed, being flat amounts. Thus final rates would be now too

[2] Allowances are usually made on the basis of a percentage of the rate up to the point where the deduction is made.

[3] It should be understood that the schedule itself is not nearly as simple in form as might be supposed from this brief description. On the contrary, many features of construction may be considered. The Universal Mercantile schedule lists 1,000 distinct occupancy classes and a formula for calculating the exposure hazard is necessary.

[4] This is not intended to detract in any way from the value and importance of the Universal Schedule, which, as elsewhere explained, was one of the most notable contributions to fire insurance ratemaking.

low, now too high; in order to adapt the schedule to conditions it was necessary to change all or a part of these fixed charges. The schedule thereby lacked stability and was apt to lose consistency. Thirdly, there was an absence of relation between charges and credits for certain features of the risk which were seemingly related. Thus 15 cents (say) were added to the risk for an open stairway, regardless of the area of the building, its height, character of floors, or other features. Whatever relations might prevail originally were also likely to be lost through the necessary process of "patching" referred to above.

As might have been expected the second important universal schedule, the "Analytic," was an improvement in many respects over the Universal. In general, it presented a better formulated analysis of hazard and a concentration of judgment at one basic point instead of at many points. A schedule, by the theory of the new system, was a standard used to measure the relations of the hazards of different parts of a risk, the relations of similar or different risks in different places and the relations of similar or different risks at different times. In order to bring about a relationship between the schedule additions and deductions for features of the risk itself practically all such additions and deductions were made percentages of the basis rate and they vary as the basis rate varies. In order to bring about a place relationship a number of tables giving basis rates[5] are constructed, from which a rate giving satisfactory results can be selected after trials with a large number of risks in several towns. This schedule can be adapted to changing conditions, or to continue the terminology used, time relations can be maintained by changing the basis rate to meet the changing loss ratios when necessary. Since all parts of the schedule are connected and vary together this is relatively easy.

It can be seen that, regardless of any opinion respecting its practical application and results, the Analytic Schedule marked a distinct advance in theory. Features which cannot here be considered, for lack of space, showed the progress which had been made in the analysis of hazard and from what has been said it is evident that the Analytic system was not open to some of the criticisms which were directed against the Universal Schedule. There was a fundamental and important distinction between these two methods

[5] The basis rate varies with the height of building and class of town.

which cannot be overlooked. The Universal Schedule was deductive in nature, seeking to describe various portions and kinds of hazards and to set a value on each, from which rulings a rate could be arrived at. The Analytic Schedule was pragmatic, seeking to arrange a series of relations, the expression of which in absolute amounts would depend upon the results to be attained. A basis rate was to be selected such as would yield a fair profit to the insurer. If aggregate results show only a fair profit and all relations have been correctly established the allowances and deductions for the various elements of hazard must be equitable. This changes the basis of charges and credits from deductions to facts and statistics. Increased importance in determining rates is given to the changing fire losses and the aggregate amount which must be collected to yield a profit. It is most important to see how well this improvement in method satisfied the increasing public disapproval of what were considered inequitable discriminations in rating, for such an understanding is fundamental to an appreciation of recent developments.

PUBLIC ATTITUDE TOWARD RATES

Of late years the problem of fire insurance rating has continuously engaged the attention of legislators, almost to the exclusion of other important phases of the business. Investigations have been conducted in at least nine states[6] during the past six years and several distinct types of laws have been evolved for the regulation of the companies' activities. The space devoted to rating problems in technical journals has vastly increased. Criticisms of methods employed have been so severe as to induce several states to endow the commonwealth with the power to fix the price to be paid for insurance. It is evident that underlying such widespread and continuous dissatisfaction there must be some basic contentions, some identical thoughts common to all these forms of expression, some issues which deserve to be recognized and met. From a study of the press and the available literature, including reports of the various investigations conducted, there appear to be three distinct contentions advanced by legislators, insurance officials and the persons who purchase fire insurance.

(1) The first of these, that fire insurance companies have in

[6] New York, Wisconsin, Missouri, Ohio, New Jersey, Pennsylvania, North Carolina, Kentucky and Illinois.

general over a considerable period of time made exorbitant profits, is losing weight. Those who make this claim contrast the total profit derived from the risks written and from interest earned, with the capital stock of the companies. This would sometimes show a profit of 85 per cent on the capital stock. The capital stock is not, however, in the economic sense the real capital, which in fact comprises the capital, the surplus and a certain portion of the reserve. Comparing the profits with the real capital would show a ratio of perhaps 11 per cent. A New York investigation led to the conclusion that the six largest companies earned on the average about 10.1 per cent on this basis and had a dividend rate of 5.4 per cent from 1890 to 1909. Medium sized and new companies had a much less favorable experience. It would seem that with respect to this contention the critics have at least exaggerated matters.

(2) It is claimed that it is unfair to compel the citizens of a state which has yielded profitable results to underwriters for years to bear the burden in part of citizens of other states in which the experience of the companies had been unsatisfactory, not to say disastrous. This argument may be best illustrated by the following statements, which are virtually condensed abstracts from the report of an insurance superintendent.[7] "There is no reason for imposing the highest level of rates on Illinois, as is shown by the following table; and yet rates in Chicago, for example, range from 30 per cent to 50 per cent higher as regards buildings and from 11 per cent to 30 per cent higher as regards contents than in four or five other states. This is demonstrated by the following figures:[8]

		1810–1913	
States	*Loss ratios for the states*	*Building*	*Contents*
Chicago, Ill.	50.5%	.68	1.28
Cleveland, O.	52.1	.47	.91
St. Louis, Mo.	59.0	.59	1.10

"Dean Schedule rates vary according to the basis rate which is used. The following is a comparison of the basis rates for Illinois and other states of the Middle West.[8]

[7] Report to Gov. Edward F. Dunne on Investigation of Fire Insurance Conditions and Rates in Illinois, 1915.

[8] The accuracy of these figures and correctness of the statistical methods employed are immaterial; they are merely copied to illustrate the argument advanced.

	DEAN SCHEDULE BASIS RATES			
	BRICK		FRAME	
	Building	*Contents*	*Building*	*Contents*
Illinois (North)	60	70	95	100
Illinois (South)	70	70	95	100
Ohio (prior to 1914)	50	70	90	95
Ohio (1914)	50	60	80	80
Wisconsin	50	70	90	90
Kansas	60	70	95	95
Ind., Mo., and Mich.	60	70	95	95

Thus it appears that higher rates are charged in Illinois than in Ohio and Missouri, whereas the latter states show a higher "loss ratio." This contention may to some degree be likened to the demand of individual employers for an allowance in compensation rates because they have had fewer or less costly accidents than other employers in the same business or industry.

(3) It is claimed that it is unfair to compel the owners of profit-yielding risks to bear the burden in part of unsatisfactory classes of risks. A concrete illustration of this criticism is the question asked by the Superintendent of Insurance in Missouri:[9] "Why is the basis rate on grain elevators $1.50 and on iron foundries $1.00? Why a basis rate of $3.45 on the mill room of a distillery and 35 cents on the transformer station of an electric light plant?" He goes on to state: "I assumed that when the companies fixed a basis rate of $2.00 on a given classification this could be justified by their experience but was soon informed that this was not the system in vogue." This contention merely embodies an extension of the principle of the application of experience, statistically presented, to the rating of classes of risks.

Summarizing the attitude of the critics, they challenge underwriters to justify their rates by statistics and contend that experience should be the basis of rate-making.

RECENTLY PROPOSED SOLUTIONS

The Universal Mercantile Schedule and the adaptations thereof made practically no attempt to justify their results by statistics. Individual companies in the main regarded what figures they possessed as a part of their stock in trade, and the underwriters' associations were usually powerless to collect the data necessary to

[9] Report of Insurance Superintendent of Missouri, 1912.

measure the equity of the schedule's application to various classes of risks. The same is true of the Analytic Schedule. In fact its author stated that "statistics can never give us the slightest clue as to the adequacy of these charges or credits. The causes of most fires cannot be ascertained. . . . . An instant's thought will show that we are forever precluded from obtaining through classified statistics the contribution of such factors as area, height, wall thickness, floorway openings . . . . or any other of the features of hazard enumerated in a modern tariff."[10]

A rate expert who made the rates in Missouri said, "I have never seen any statistics covering fireproof buildings. I have no statistics to justify any of the basis schedules other than what I have quoted as to the average experiences of the State of Missouri, and they cover only the aggregate results. Many of the schedules may be too high, and others too low, but in the aggregate they produce fair and reasonable profits."[11] An insistent demand at the Annual Conventions of Insurance Commissioners that such conditions be remedied resulted in the establishment by the National Board of Fire Underwriters of an Actuarial Bureau to ascertain fire loss costs. Subsequently two new schedules were devised, one combining some of the features of the Universal and Analytic systems and the other designed to make use of the data collected by the Actuarial Bureau mentioned.

The L. & L.[12] *Schedule.* While varying greatly in the methods adopted to accomplish its purpose, this schedule is not fundamentally different from the Universal Schedule. The values assigned to the elements of hazard appear to be dependent upon combined judgment and such conclusions as may be drawn from the results of intelligent experimentation. Certain of the methods of arriving at particular items bear some resemblance to features of the Universal Schedule, such as beginning with a basis rate for a standard building in a given city, charging flat sums for defects and deducting by percentages. Two features in particular, however, are distinctly novel; the use of a factor designated the "burning degree," and the emphasis placed upon the influence of floor resistance.

The "burning degree" is a figure deduced from the type of

[10] A. F. Dean, *Fire Hazard: Is It Measurable?* p. 20.

[11] *Report of Superintendent of Insurance of Missouri*, 1912, testimony of Mr. H. M. Hess.

[12] Full title "The Larter and Lemmon Rating System," New York, 1916.

building construction and the nature of the occupancy and indicates the ignitibility and combustibility of the risk; this figure is frequently used as a multiplier in certain sections of the schedule. Reference to a table of occupancies provides three burning degrees for each class of occupancy—one when situated in a fire-proof building, one in a brick building and one in a frame building. The object of this device is to allow a table prepared with one set of charges to be intelligently used in connection with all classes of risks. The manner in which the burning degree is used will serve to illustrate this. Suppose in a risk, an area of 5,000 square feet, the minimum schedule charge being 1 cent per 1,000 square feet or a total of 5 cents. If this area is occupied by a stock of wholesale groceries the charge of 5 cents is multiplied by 2, this being the burning degree for such an occupancy, and the final charge becomes 10 cents. If occupied as a garage for gasoline cars with a burning degree of 4 the final charge becomes 4 times 5 cents; celluloid stock, 8 times 5 cents; etc. The burning degree is applied to the charge for occupancy in the same manner. A table of occupancies provides initial charges for various kinds of occupancies in cities of different classes, and these initial charges are multiplied by the burning degree of the risk to arrive at the final charge for occupancy. The same is true of the initial charges for ignition hazards, obtained from a table of hazards, and also charges for unprotected interior supports. Thus the initial charge of 2 cents for a coal stove would be multiplied by the burning degree of a furniture store, if situated therein, the final charge being 3 times 2 cents. In brief, the object sought by the use of the burning degree is the regulation of charges for area, occupancy, hazards and supports in accordance with the environment of these factors, that is the ignitibility and combustibility of the risk. For convenient notice the features of hazard to which the schedule applies the burning degree are indicated on the following chart by enclosure in dash lines.

Considerable credit is given for efficient floor separation because of its value in resisting the spread of fire from story to story. While the burning degree is used as multiplier the figure representing "floor resistance value" is used as a divisor. It affects the charges for area, ignition hazards and occupancy. Thus suppose a building of five stories with a total floor space of 30,000 square feet, and floor and opening protection which is given a value of 175 per cent.

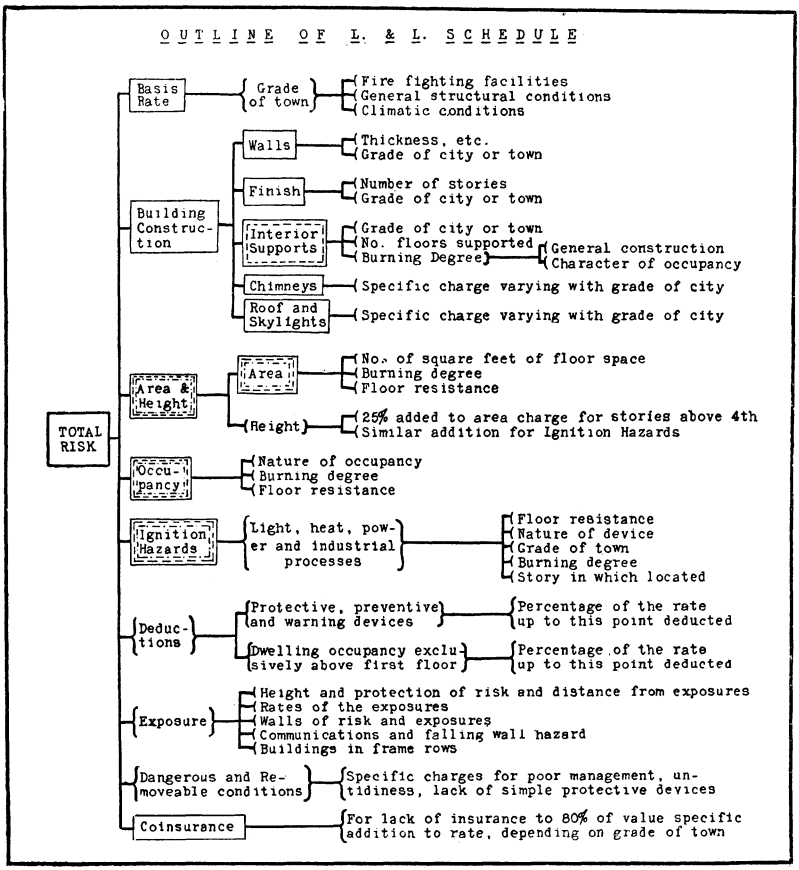
The total area charge[13] for 30,000 feet of floor space after allowance for burning degree assume to be 42 cents. This is divided by 1.75 reducing it to 24 cents. Ignition hazard charges and occupancy charges are similarly treated. For convenience these three charges are added before dividing by the floor resistance value. For convenient notice the features of hazard to which the floor resistance reduction applies are designated in the following chart by enclosing them in dot-and-dash lines.

It should also be noted that in this schedule the grade of the city or town in which the risk is located is considered not only in the basis rate, but in several other connections; it is a factor in determining the initial charges for building construction, area, occupancy and coinsurance. The effect of the grade of town upon the charge for area will serve as an illustration of its influence. The initial charge per 1,000 square feet in a city of the first class is .7 of a cent; in a town of the tenth class the charge is 2.3 cents. The factors of hazard influenced by the grade of city or town in which the risk is located are indicated on the accompanying diagram by enclosure in solid lines.

It is desirable, in order to afford something of a general view of the system followed by this schedule to introduce the following diagram, bearing in mind, however, that such a diagram can only furnish a crude sketch of its general outlines and not a detailed description of the methods used for valuing the sub-divisions of hazard. Viewed from top to bottom the diagram presents the order in which the items of hazard are considered in the schedule. Thus it proceeds from the basis rate to the features of building construction, the area and height, hazard of occupancy, hazards of ignition, deductions for good features such as protective devices, exposure of the risk to environment, lack of care and precaution and finally, failure to sufficiently insure the property. Viewed from the left to the right side the diagram attempts to present a rough sketch of analysis of the main features of hazard and brief notes of the factors considered to affect the various sub-divisions of hazard. Thus the basis rate is determined by the character of the town in which the risk is situated; the building construction is considered under the heading of walls, finish, interior supports, chimneys, roof and

[13] Not including, however, an addition of 25 per cent to the charge for each floor above the fourth.

skylights. The charges in connection with the item of walls are determined by the grade of the town in which the risk is found and the character of the wall construction as compared with the standards established by the Building Code of the National Board of Fire Underwriters. Other main elements of hazard are similarly analyzed. In order to bring to attention the significance of the three exceptional ideas of this schedule, the features of hazard affected by the grade of city are enclosed in solid lines, the features of hazard affected by the burning degree are enclosed in dash lines, and the features affected by floor resistance in dot-and-dash lines. Thus a general impression can be formed of the extent to which the application of these three ideas affects the rate on a risk.



Only considerable experience in its actual application to a number of risks would make it possible to judge of the ultimate results of such a schedule. While it is being used experimentally in certain territory no conclusion has yet been arrived at by underwriters as far as is known, regarding its ultimate value. Viewing it in a broad way, however, one fact seems important. Will it serve to any extent to remove the dissatisfaction hitherto existing with fire insurance rating methods? It will be remembered that earlier in this paper the two principal criticisms of methods extant were founded upon one conception—that a difference in rates as between localities or between classes of risks should be statistically justifiable. In other words, it is demanded that the foundation of judgment of the equity of rates shall be experience reflected in statistics. The public appears to refuse to be satisfied by the experience, judgment, or whatever it may be termed, of underwriters, however experienced or expert they may be or however logical their reasoning. Nothing less than figures will satisfy it. Then however much of an improvement over previous theories any schedule shows, unless it can justify itself by recourse to classified experience[14] it does not approach the standard for which critics are contending. This article is not an attempt to prove the feasibility of experience rating, for which proof probably an actual test is indispensable, but rather is intended to raise the question of whether such a test, from the standpoint of the insurers, is not highly desirable.

The E. G. R. Schedule.[15] In distinct contrast with all the schedules previously mentioned the E. G. R. schedule is an attempt to devise a method of ascertaining the total cost of insuring risks of varying character by an analysis of statistics of past experience. In order to be successful the statistician who furnishes the ultimate data from which rates are derived must be provided with an "insurance written" and a "loss" card for every risk, showing the state and the city or town in which located, the occupancy class in which the risk falls, the amount written, the term of the contract, the expiration, the grade of building, the grade of occupancy, the grade of internal

[14] "Classified experience" must be carefully distinguished from the "classifications" described earlier in this paper, which have little if any value for rating purposes.

[15] Full title *The Experience Grading and Rating Schedule*, by E. G. Richards, until recently President of the National Board of Fire Underwriters, New York, 1915.

exposure and external exposure, etc. The use of this information will be apparent later. It is proposed when the data are available to divide and subdivide the cards in order to arrive at the particular kind of information desired. For this some method of classification must be adopted.

The method of procedure is (1) to ascertain the ratio of losses, expenses and a fair profit to the insurance written on all risks in the United States, (2) to obtain a similar ratio for the average risk in each particular state, (3) to ascertain the average United States' rate on a risk of a specific class. Since the first two steps given are to be accomplished with relative ease, consideration of them may be deferred until later and attention first devoted to the method employed in connection with the ascertainment of an average United States' rate on a risk of a specific class. It is to be emphasized that the data for this rate are to be obtained from experience throughout the United States, for no one state is sufficiently large to furnish a safe average experience upon a given class of risk.

In order to classify experience for obtaining a rate on a risk of a specific class, three principal features of hazard are distinguished. The cards above mentioned are to be divided according to inherent hazard, internal exposure and external exposure. Being a departure from the rather general division of hazard into construction, occupancy and exposure, these classifications require some definition. *Inherent hazard* is the danger of loss due to inherent qualities of an occupancy; the volume of inherent hazard would be modified by the character of building in which contained. *Internal exposure* is the danger of loss due to the presence in the building of occupancies other than the risk under consideration. *External exposure* is the danger of loss by reason of surrounding hazards outside the building of the risk in question. Therefore the total hazard is considered as comprising the hazard emanating from the inherent qualities of the risk in question, the hazard consequent upon the existence in the same building of other occupancies and that present by reason of the environment outside the building in which the risk is situated. The method of treating these three principal features of hazard is similar and a detailed description of inherent hazard alone will be sufficient.

The cards of inherent hazard are first divided into ten grades of towns; the town grades being determined by a plan of the Fire

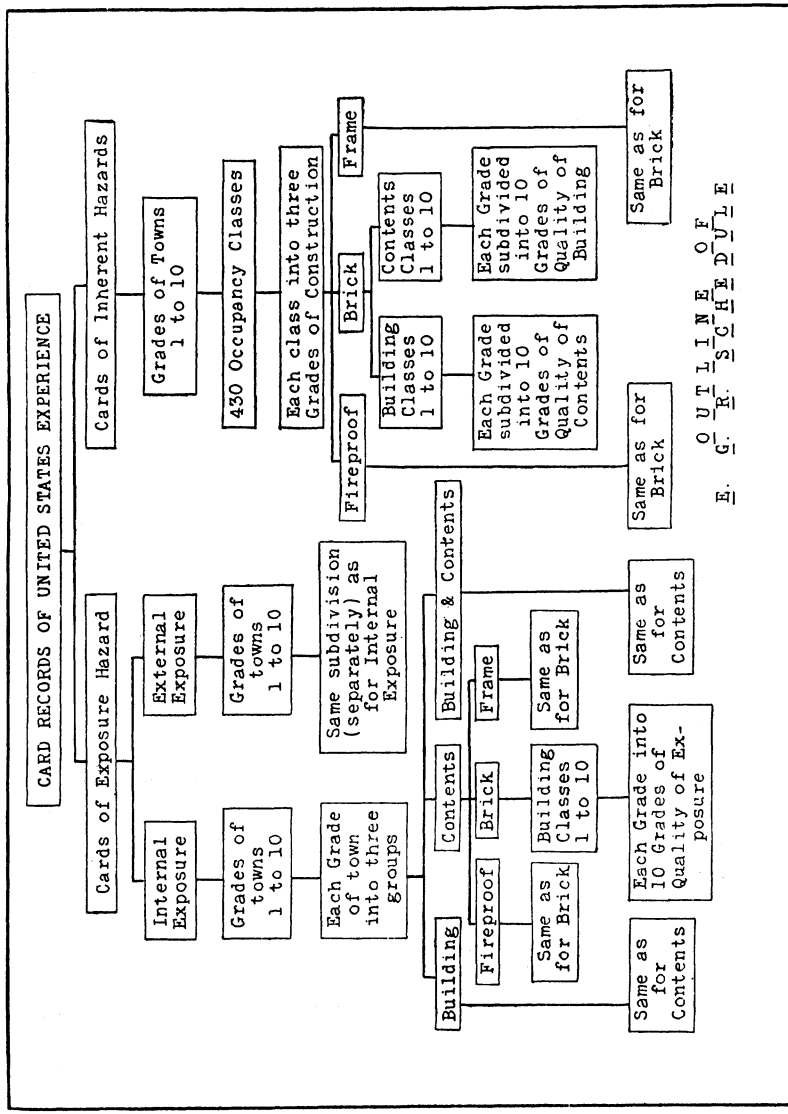
Prevention Committee of the National Board of Fire Underwriters. Each town grade is then sub-divided into 430 occupancy classes, according to a National Board occupancy table which designates building risks by odd numbers and contents risks by even numbers. A *building* containing wholesale groceries is No. 137 and *wholesale groceries* contained in a building No. 138. These occupancies are classified as being in fireproof, brick or frame buildings. Occupancies in fireproof buildings are then sub-grouped in 10 classes, according to quality of building if a building risk or quality of contents if a contents risk, and brick and frame buildings are similarly treated. There now exist for each occupancy thirty quality grades of building risks and thirty quality grades of contents risks. Each of these thirty grades must then be sub-divided, the building risk grades into ten groups according to the quality of contents and the contents risk grades into ten groups according to quality of building. In brief, the amount of risk is determined by (1) the type and quality of building construction, of which there must be many classes, to allow for the variety of risks to be found and (2) the class and quality of the occupancy, of which there must be many groups for the same reason. After such a division of experience, it will be possible to determine, for example, inherent loss cost upon a wholesale groceries risk of the fifth grade situated in a brick building of the 1st class in a first-class city. Assume this to be, for sake of illustration, 87 cents per $100 of insurance.

It is necessary now to classify the cards of writings and internal exposure losses, which is done in a similar manner, except that subdivision into each occupancy class is now unnecessary. Following the same plan of refinement of experience, ten grades of quality of exposure for each of ten classes of buildings are finally arrived at. It is now possible to ascertain for example the loss cost of a grade 2 internal exposure to an occupancy in a grade 1 brick building in a first-class city; which assume to be 35 cents.

A similar process for external exposure reaches a similar climax and an external loss cost of 23 cents.

Thus an inherent loss cost of 87 cents, an internal exposure cost of 35 cents and an external cost of 23 cents compose the total loss cost of the risk, $1.45 per $100 of insurance. A summary of the procedure thus far is given in the accompanying chart.[16]

[16] Originally published in the author's "Fire Insurance Rates," *Quarterly Journal of Economics*, August, 1916, and reproduced here with the kind permission of the *Quarterly Journal*.


CARD RECORDS OF UNITED STATES EXPERIENCE
Cards of Exposure Hazard
Cards of Inherent Hazards
Internal Exposure
External Exposure
Grades of Towns 1 to 10
430 Occupancy Classes
Each class into three Grades of Construction
Fireproof
Brick
Frame
Grades of towns 1 to 10
Grades of towns 1 to 10
Each Grade of town into three groups
Same subdivision (separately) as for Internal Exposure
Building
Contents
Building & Contents
Building Classes 1 to 10
Contents Classes 1 to 10
Each Grade subdivided into 10 Grades of Quality of Building
Each Grade subdivided into 10 Grades of Quality of Contents
Same as for Brick
Same as for Brick
Fireproof
Brick
Frame
Same as for Brick
Building Classes 1 to 10
Same as for Brick
Same as for Contents
Same as for Contents
Each Grade into 10 Grades of Quality of Exposure
E. G. R. S C H E D U L E O F

But such cannot be the rate on the risk for it would make no provision for expenses or profit. A study of expense statistics leads the schedule's author to the conclusion that expenses are about 41½ per cent of all costs; therefore the loss cost, $1.45 must be 58½ per cent of the total cost. In this basis $1.02 would have to be added to the loss costs for expenses, giving $2.47 as the total cost. Adding to this 5 per cent of itself, or 12 cents for profit, the final rate is $2.59 for a risk of this particular nature *in the United States*.

But losses and expenses on risks vary with the state in which a risk is situated. One of the complaints against other systems of rating, as was noted, was the failure to give sufficient consideration to the loss record of the state. It is necessary to proportion this rate of $2.59 to the loss record of the state in which the risk is situated, which we may assume to be New York. The average rate of premium for all risks in the United States is found, by reference to statistics which are available of stock companies' underwriting experience, to be 112.5 cents, this figure including expense and 5 per cent profit. The average rate of premium for all risks in New York is found to be 75.1 cents.[17] The risk in New York state should pay only about 751/1125ths of the average rate of a particular class of risk in the United States. For a risk of the kind for which figures have been assumed here, situated in New York state, the rate would therefore be 751/1125ths of $2.59 or $1.73 per $100 of insurance.

A noteworthy feature of this system of measuring hazard is the avoidance of dependence upon the experience of a single state. Instead the rate for a given kind of risk *in the United States* is arrived at and the rate for a given risk *in any particular state* is found by a proportion in which the rate in the given state is to the rate in the United States as the experience of the state is to the experience for the entire United States. By this device the danger of inadequate data as a basis for premiums is immensely reduced while, on the other hand, the risks in every state are rated in accordance with the experience of their particular state. The E. G. R. schedule is thus plainly an endeavor, however successful or unsuccessful may be its results, to fairly meet the objections of critics to existing methods of measuring hazard.

[17] In arriving at the average rate for a state unusual conflagration losses are apportioned among all states. California's loss cost would be 2.327 if it bore the total conflagration loss itself but is considered as only .716 per cent after the conflagration loss is distributed among all the states.

With regard to conflagration losses it has always been contended that no single state's experience was sufficient to form an average, since conflagration losses are sudden, extremely large and occur at indeterminate intervals; and statistics of fire losses verify this assertion. The costs of such uncertain and incalculable losses, if collected solely from the risks of the particular state in which the great fire occurred, would make the average rate so excessive as to be uncollectible. Thus the Bangor fire causes the average loss cost in Maine for the ten years 1903–1912 to be $1.02, the Baltimore fire makes the cost in Maryland $1.26 and the San Francisco fire raises the cost in California to $2.33. Only the entire United States experience (if that) will suffice for the averaging of such losses, and the schedule under consideration arranges for this by distributing them among all the states. Apportioning the large losses of this kind among the states, the loss cost of Maine is reduced to $1.00, that of Maryland to .47 and that of California to .72. It is alleged that formerly the companies were accustomed to recoup such losses in such localities and from such classes of risks as might be most convenient without regard to the equity of the collections. Thus it was stated that "In applying the San Francisco advance, the exchange was instrumental in perpetrating an injustice upon the insuring public. . . . . Assuming that necessity existed for such a step, the burden should have been equitably distributed over the entire country or at least over the conflagration areas of the country. As it was, rates were not advanced everywhere, nor was such advance uniformly maintained where it had been effected."[18] Any effort to provide a systematic method of treating the advances in rates made necessary by conflagrations is certainly to be commended.

But the fundamental and basic feature of importance in this schedule is the effort to provide a statistical foundation for rates, so that the latter become the exact reflection of the results of experience. This endeavor strikes at the root of the criticism that the equity of a rate should be demonstrable by figures, and if feasible will definitely remove the present objection to methods of rate-making. However unsatisfactory the immediate results may be conceived to be, such a proposal affords at least an opportunity for the constant improvement of a single and well-defined plan as con-

[18] Report of S. Deutschberger to the Insurance Dept. of N. Y. July 21, 1913.

trasted with the previous procedure of successively presenting different types of schedules in the hope that one might be attained which would render results satisfactory to the public and the underwriters. It would seem that the proposal to utilize experience in a statistical form would appeal equally to the insured and the insurer, inasmuch as it would be of immense assistance in removing the prejudice and ill-considered legislation which have rendered unpleasant the past relations of the companies and the public.

A few words may be said concerning the collection of the data necessary to make practicable the plan outlined. On January 1, 1915, a standard classification was adopted and the Actuarial Bureau of the National Board of Fire Underwriters began the collection of experience from nearly 190 companies, fully one-third of which were mutuals and non-members of the National Board. Its work has been greatly furthered by the coöperation of the insurance departments of a number of states and there were in May, 1916, 236 companies coöperating in the work, including 125 National Board companies, 59 non-member companies and 52 mutuals. During the year 1915 about 650,000 loss reports were received and at the present rate there will be on file at the end of 1916 over a million reports of losses sustained and paid by members of the Bureau.